Septimò, *Utrum componentes cujuſvis miſcelæ colores reverà mutentur; an verò ſecernantur duntaxat, quando ex mixturâ illâ varii colores rurſum producuntur per Refractionem?*

Octavò, *Denturne ulli alii colores Refractione producti præter eos, quos oriri oportet à Coloribus, ad radios diverſimodè refrangibiles pertinentibus, dum illi refractione iſtâ ſecernuntur vel miſcentur?*

Per Experimenta determinare hæc ſimiliave Quæſita, quæ propoſitam Theoriam involvunt, maximè genuina directaque videtur ad Concluſionem via: Proindéque omnes velim Objectiones ſuſpendi, quæ ab Hypotheſibus deſumuntur ulliſve Fontibus aliis, quàm his duobus; quibus nempe vel *oſtendatur Experimentorum ad determinanda hæc* ζητήματα *probandaſve ullas aliàs Theoriæ meæ partes inſufficientia, hallucinationes defectuſque in Concluſionibus meis inde deductis indigitando;* vel *alia producantur Experimenta, è diametro mihi oppoſita, ſi quæ talia occurrere videantur. Si enim Experimenta, quæ à me urgentur, laborant defectibus, difficile haud fuerit eos oſtendere; ſi verò validâ fuerint, eo ipſo dum Theoriam meam aſſerunt probantque omnes Objectiones convellunt.*

Some Annotations of the Learned Dr. Walter Needham *upon a Diſcovery pretended to have been made by the famous Monſieur* Pecquet *of a Communication between the* Ductus Thoracicus *and the* Inferior Vena Cava.

The Relation it ſelf of that pretended Diſcovery, as it is to be found in the Journal des Scavans, *of* Feb. 8. 1672.

THE Diſcovery made about twenty years ſince by M. *Pecquet* of the *Ductus Thoracicus*, ſeemed not ſufficient to clear up all the Difficulties to be met with in the New opinion, which this Channel hath occaſion'd, concerning Sanguification.

It might be ſaid among other things, That there appears no reaſon, why Nature, which does nothing without deſign, ſhould carry the matter of the Blood into the *Sub-clavials*, and thence make it deſcend by the Trunck of the *Vena Cava*, (*A*,) unleſs it be to keep the Chyle from entring all at once and altogether pure into the Heart, and that the mixture, which is made of the Chyle with the Blood along this way, may diſpoſe the Chyle, by a kind of contagious fermentation the more

The Annotations of Dr. *Needham.*

(A.) *I think the reaſon there mentioned to be very ſufficient for the inſerting of the Trunck of the* Ductus Thoracicus *into one place alone; at leaſt as good as any that are afterwards given to prove the contrary. For, all proofs of this nature are but looſe conjectures at the beſt: the matter admitting of no other demonſtration than what is ocular.*

(B.) *Till the* Lower *inſertion be ſhewed, we are bound to believe, that Nature thought the ſingle*

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more eaſily to receive the character of the Blood in the Heart: But that this might be more conveniently done, the *Ductus Thoracicus* being inſerted into that trunck of the *Vena cava* which *aſcends* to the Heart, becauſe that this way is ſhorter, and is equally favourable to this commixture.

It might alſo be objected, that, ſuppoſing this commixture were of importance, the *Ductus Thoracicus* ſhould communicate with the *inferior* trunck of the *vena cava* as well as with the *ſuperior*, to the end that the moiety of the Chyle being mixt with the blood that comes from on high, and the other moiety with the blood that comes from beneath, (*B*) it might the more eaſily be altered by this commixture. And this Objection ſeemed the more rational, becauſe, it being very likely that the Blood, which returns from the parts in which it hath received ſome impreſſion in penetrating their poroſities, communicates to the Chyle theſe ſame diſpoſitions; there was reaſon to deſire, that the Blood which re-aſcends might in ſome degree impreſs the peculiar character of the inferior parts, as that, which comes from the upper parts, impreſſes upon it that which belongs to it.

(*C*.) Add hereunto, that the Blood which re-aſcends to the Heart, muſt be more perfect than that which deſcends; becauſe it comes from being purified in the Liver, Spleen, and Kidneys; ſo that it is capable to give (*D*.) to the Chyle good impreſſions.

(*E*.) Laſtly, it might be ſaid, that, ſuppoſing it be neceſſary that not only a portion of the Chyle paſs through the Heart, to give it ſome kind of refreſhment, but alſo that all the Chyle be conveyed thither for to be converted into Blood; the ſmall orifices, which the *ductus thoracicus* hath in the ſubclavials, ſeem not to *commixture of Blood and Chyle ſufficient. The reinforcement of that Objection anſwers it ſelf, being propoſed in no other terms than* (it ſeems very likely;) *the whole conjecture having yet had but very ſlender foundation in Philoſophy. And if there be any thing in the notion of impreſſing characters, it is more attributable to the* lympha. *See beneath lit.* D.

(C.) *That the Blood, which re-aſcends to the Heart, is purer than what deſcends from the Head*, &c. *is a notion that will not eaſily be granted, neither can it be made out by Experiment. I have my ſelf compared the Blood of the jugular vein with that of the Crural in a Dogg, and found no difference. The ſeparations made by the Kidneys and Liver (if they prove any thing) prove the aſcending blood to be thicker than the deſcending; it having loſt in thoſe places much of its* ſerum *and its lixivial ſalts, which are the great inſtruments of attenuation. But withall it is to be conſidered, that the Blood, which aſcends from the Heart to the Head, parts with much excrement in the* glandulæ ſalivales, *and noſtrils, and the whole throat; the quantities of which are much greater than will eaſily be imagined. There is like-*

be

be large enough for that purpoſe.

(*F.*) The Obſervations, that have been made in the beginning of this year in his *Majeſties Library*, by ſearching carefully the paſſage of the *Ductus Thoracicus* in the Body of a Woman, did ſhew, that theſe difficulties were well grounded. For, it hath been found by divers Experiments, made about this matter, that there *aſcends* at leaſt ſo much Chyle through the Trunck which is beneath the Heart, as there *deſcends* through that which is above it.

Theſe Experiments have appeared conſiderable, in regard that they confirm thoſe, which were alſo made by the ſame *Royal Academy of the Sciences* about five years ſince, and which were inſerted in the *7th Journal des Scavans* 1667 *. But this laſt Experiment hath been clearer and ampler then the firſt, in that the Communication, which the firſt time appeared to be only with the left *Emulgent* Vein, hath been found this ſecond time not only with *this* vein, but alſo with the two *Lumbary* veins, which are inſerted in the Trunck of the *inferior vena cava.*

*See *Numb.*25. *of theſe Tracts* p. 461. *where thoſe Experiments were Engliſh't.*

As to the manner of proceeding, in the preſence of the whole Company, for finding this Communication, it was this: After there had been ſhewed the Commerce of the *Ductus thoracicus* with the Right Ventricle of the Heart by an injection of Milk, which having been ſyringed into the beginning of this Channel, iſſued in great quantity through this ventricle; we tyed the Trunck of the *vena cava* above the Heart, ſo that nothing might paſs that way; and the Trunck of the *Emulgent* and that of the *Vena Cava* having been opened above long wiſe, ſome milk, ready to boyl, was (*G.*) injected *wiſe a great ſeparation made in the brain; which whether it be of the pureſt and beſt ſpirits of the blood, ſo as to leave it depauperated; or only of a nutritious* ſerum, *ſuch as is made in all the ſolid parts, is hard to ſay. Only this may be certainly ſaid, that the* Lympha *does wholly exonerate it ſelf into the ſub-clavial and jugular veins near the place of the inſertion of the* Chyle; *whereby the whole Chyle is diluted, and the mixture of it and the blood facilitated. Which very* phænomenon *is a greater argument to prove, that the Chyle does* wholly *enter by that paſſage, than any can be produced on the other ſide. For we ſee, all the* Lympha, *not only of the Liver and Inteſtines, but alſo of the lower limbs, to powre it ſelf into the* receptaculum chyli, *and not into any of the lower veins: Whereas the Lymphaticks of the Head, Neck and Arms, think it ſufficient to meet the Chyle at the place of its entrance; which ſame thing might have been done by the* lower *Lymphaticks, had they any Chyle to meet: The principal uſe of the* Lympha *ſeeming to be, to ſerve the uſes of the Chyle and its mixture with the Blood.*

(D.) *What impreſſions are made on the Blood by the Liver, Spleen, Kidneys,* &c. *is*

into

into the *Emulgent* through the left *Lumbary* vein (which we have ever obſerved to come from the *Emulgent*,) and at the ſame time we ſaw it come away through the other *Lumbary*.

This Experiment having been ſeveral times repeated without our being able to ſee the track, which we had obſerved under the *Pleura*, when the firſt Diſcovery of this Communication was made; which track ſeemed to ſhew the way, which the Thoracick branch keeps to entertain a communication with the *inferior vena cava*: We reſolved to attempt a more eaſie and a more certain method of diſcovering this branch, than the uſual diſſection of the veſſels, performed by ſevering their proper tunicles from a multitude of membranes and fatneſſes, which lying and embaraſſing them, render this work very difficult; eſpecially when the veſſels are not filled with blood to make them viſible, and becauſe they are compoſed of more delicate tunicles, than thoſe of the Veins.

(*H.*) This way was, to ſyringe into the Trunck of the *ductus thoracicus* a Compoſition, that might run into it being hot, and which by being refrigerated might become ſolid enough to afford a greater facility to follow and trace the channels, in the cavity of which it ſhould be thus hardened. And this deſign ſucceeded in part. For, the Compoſition filled the whole *ductus thoracicus* and aſcended as far as into the *ſub-clavial*; but there paſſed nothing into the channel that makes the communication ſought for, though care was had to warm the ambient parts by ſeveral injections of warm milk, to the end that the Compoſition might not harden before it had penetrated into all the conduits. We alſo tryed to inject the ſame Compoſition through the *Lumbary* that iſſues out of the Trunck, if its valves would permit it; but *they* ſtopped all that we endeavoured *uncertain: But if there be any ſuch made, the Liver and Kidneys do ſo readily exonerate themſelves into the* vena cava, *that the impreſſions; be they what they will, are quickly conveyed to the Heart without any great diminution of them. And whereas the Author mentions the characters impreſſed from parts; thoſe, (if any ſuch be) may more juſtly be ſuppoſed to be conveyed in the* lympha, *which liquor ſeems to be a product of thoſe parts curiouſly elaborated in the very ſubſtance of them.*

(E.) *What is ſufficient and not ſufficient, muſt be judged of by Nature, and not by Us. Yet, if we conſider the time that is ſpent in carrying the Chyle up into the Blood, it is eaſie to believe, that a much greater quantity of liquor may be diſcharged by that* ductus, *than is uſually pretended to.*

(F.) *What thoſe Experiments are, we ſhould be glad to know. But the Experiment of* 1667 (*if I rightly remember it*) *was only a* luſus naturæ, *found by M.* Pecquet. *Which I therefore call ſo, becauſe neither he, nor any one elſe hath found it ſince: whereas the* vaſa lactea, *and the waies of ordering them, are ſo well known, that, if any ſuch thing were, it could not long be hid.*

(G.) *An Injection into the* Lumbary *vein with its effects*

to make paſs that way, and neither the milk nor the wind would ever enter there.

(7.) The advantage we had from the Injection of this Compoſition into the ſaid *Ductus*, was, that we very diſtinctly ſaw the figure and the whole ſtructure of it, when the Compoſition wherewith it had been filled, was refrigerated and hardned. For we found, *that* that *ductus* did aſcend unto the right ſide of the heart, keeping one and the ſame ſize, which was no more than $\frac{1}{12}$ of an inch; *that* afterwards it was enlarged to $\frac{1}{6}$ of an inch in diameter; *that* in this enlargement its tunicle on the right ſide of the *vertebræ* was, as 'twere, pierced by four ſmall holes, diſtant $\frac{1}{12}$ of an inch from one another, and all diſpoſed in a row; into which holes the ſaid Compoſition had not been able to penetrate; *that* the ſame *ductus*, after having retaken its firſt ſize, had two appendixes faſhioned like ſacks; *that* there was yet a third appendix beneath the dilatation; *that* the firſt and higheſt appendix was of the form and bigneſs of a ſmall phaſeolus; *that* the third, which was beneath the dilatation, was like to the ſecond; *that* they had all a ſtreight orifice; and *that* the laſt was full of chyle conſpiſſate, ſo that the Compoſition could not enter there, as it had done into the other.

The Importance of theſe Obſervations ought to incite the Curioſity of thoſe that are addicted to Anatomical reſearches, and to engage them to examin with care this New communication, to attain at laſt a clear accompt thereof.

effects mentioned can prove nothing but the Inoſculation of the two Lumbary *veins with each other: which is acknowledged to be ſuch in all the Capillary veſſels of the ſame kind*, viz. *Veins with veins, and Arteries with arteries. But the thing required here is, the paſſage from the* Receptaculum *to the* Lumbary *vein, or to any other vein beſides the* Subclavial.

(H) *The way of ſyringing a liquor, which is apt to coagulation, into the* ductus thoracicus, *&c I think to be needleſs and unprofitable as to this Inquiry, when there is a more eaſie Experiment to be made, which is more demonſtrative*, viz. *Open a Dog at a convenient diſtance of time from his feeding, and then tye a ligature upon the* ductus thoracicus *nigh the Sub-clavial: your* receptaculum chyli *will continue full, 48 hours or longer, if you pleaſe: So that, if there be any ſuch* ductus, *it muſt remain likewiſe full with its own natural liquor, and be all that while viſible. But, if there were any ſuch* ductus, *it would in a quarter of the time empty the whole receptacle; whereas upon a ligature you'l find the clean contrary*, viz. *all the Lacteal veſſels (that are acknowledged to be ſuch,) fully diſtended: Which is a full demonſtration, that they have no way of evacuation by any other duct than the thoracique.*

(J.) *The other uſe of the coagulating Injection I applaud; though the ſame may be done by the Ligature aboveſaid. However the event of the Experiment, made by the Learned* Pecquet, *makes againſt the opinion of a New* ductus, *and not for it; as appears by the Narrative.*

The haſte, in which this was written, begs your excuſe.